AMERICAN
MECHANICS' MAGAZINE,
Museum, Register, Journal and Gazette.

Vol. I.—No. 12.] SATURDAY, APRIL 23, 1825. [Price $4 per ann.

NEW CYCLOIDAL CHUCK.

Fig. 1.

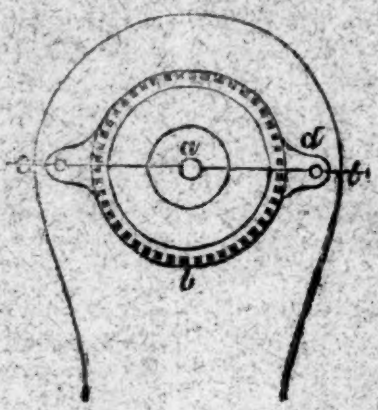


Fig. 2.

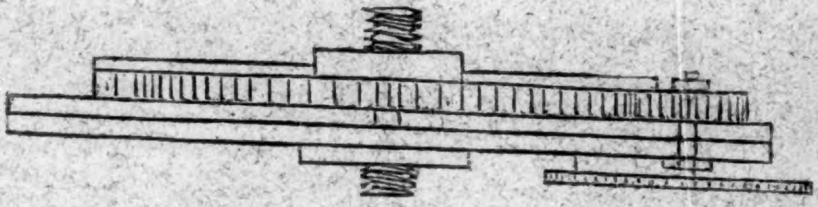
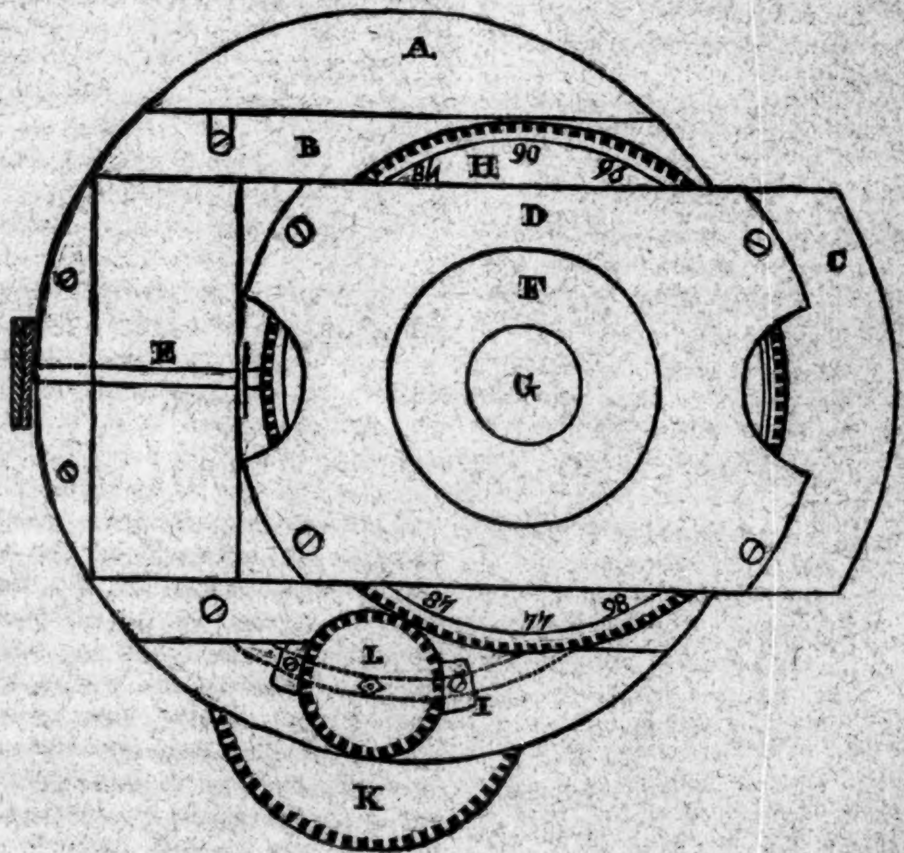


Fig. 3.



CYCLOIDAL CHUCK.

SIR,—Some time ago, one of your Correspondents asked how a Cycloidal Chuck (for ornamental turning) is constructed. I never heard that such a thing had been made; but, on a little reflection, I felt convinced it might be, and would produce a very great variety of beautiful patterns. I have looked in vain in your subsequent Numbers for a reply to your querist, and in the meantime, as my leisure would permit, have endeavoured to reduce my own ideas to practice. The result has been the completion of an instrument which I think correct in principle, and which works to my entire satisfaction; and I shall feel much obliged to any of your readers for suggestions for its improvement and perfection.

Description.

Fig. 1 exhibits a portion of the face of the lathe; *a* is the mandril; *b*, a brass cog-wheel, bolted to the head by the bolt, *c*, the wheel having been previously soldered to a piece of thin iron, with a projection on each side, *d*.

Fig. 2 is a profile view of the lathe.

Fig. 3 represents the face of the chuck.

A is a circular iron plate 3-16ths of an inch thick, carefully and accurately turned.

B, Plates for forming a groove for the principal sliding plate, C.

D, A cover for the principal wheel of thin iron, supported by four feet of brass beneath the four corner screws.

F, A piece of iron carrying the screw, G, upon which the work is to be fixed. This iron is turned with a pivot that goes through the large brass wheel, H, to which it is firmly soldered, and this pivot turns in the principal sliding plate, C. As the socket in the sliding plate is nicely drilled in the centre in the lathe, and the circle in the covering plate, D, is also turned out after it has been fixed in its place, so the wheel must revolve with perfect accuracy, and without any shake, having been itself carefully finished between two dead centres.

H, The principal wheel, cut accurately with 96 teeth, which are numbered upon it. If a catch-spring were added to the chuck, in this state it would form a strong eccentric chuck; and it would be easy to make it answer for an oval chuck, by longitudinal perforations in the foundation-plate, through which two lips might move upon the eccentric circle fixed to the head of the lathe.

I is a piece of steel, which has a corresponding one on the back of the chuck, to which it is strongly screwed, and through both of which a hole is drilled for the axis of the wheel, K, which axis carries the driving-wheel, L. There is a concentric perforation in the plate of 5-16ths of an inch in breadth, which allows the two last-mentioned plates, with the wheels they carry, to follow the great wheel, H, however far from the centre it may be set.

K is a wheel on the back of the plate, cut with 72 teeth. It is twice the diameter of the one fixed upon the head of the lathe, which is of course cut with 36 teeth. When, therefore, the chuck is screwed into the mandril, the wheel, K, revolves *once* on the fixed wheel, while the mandril revolves *twice*. The small face-wheel has 24 teeth, and is one-fourth the diameter of the great wheel, H; therefore that revolves *once*, while the mandril has turned *eight* times, and an accurate circle of eight cycloids of any diameter will be traced. By having small driving-wheels of different numbers, proper proportions of 96, the number of cycloids will be greater or less at pleasure, and may be cut nearer or farther from the centre, one within another; and by taking off the small driver, and moving the great wheel forward or backward any number of cogs, the cycloids will intersect each other with a beautiful and endless variety of forms. By making the small plates, I, sufficiently long to carry another small wheel, which I have done upon a fixed pivot, all the patterns and cycloids are reversed. But I have added mine to a rose-engine, to which I had previously adapted a drill apparatus, so that I can form the cycloids with any of the patterns upon that, or with close, wide, regular, or irregular patterns of intersecting circles of any diameter, and, had I had sufficient forethought to have made this chuck answer for oval work, all the beautiful combinations of ellipses, either simple, figured with the rose-engine, or worked in cycloids; or, in short, the kaleidoscope itself hardly can afford a more endless variety of symmetrical forms than it would have done.

I am, Sir, &c.
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Norton, near Stockton,
25th Oct. 1824.

P. S. I scarcely need to add, that the lathe with this chuck must be worked with a slow hand-motion.

AN ANIMAL CLOCK.

The note, of which the following is an abstract, was sent to the Society of Natural Sciences of Switzer, and is inserted in the Bibliothèque Universelle, vol. xxvii. page 160.

Mons. Chavannes, whilst residing during last summer at Wuarrens, near Echallens, had occasion to hear some account of a man, who, without any uncertainty or mistake, could indicate the precise hour by day or night, and even the minutes and

seconds; and this, it was said, he did by consulting his pulse. Induced by these reports to make close inquiry as to their foundation, he visited the man and obtained the following results:—

His name is Jean Daniel Chevalley, aged 67 years. In his youth, the ringing of bells and vibrations of pendulums constantly attracted his attention, and he gradually contracted a habit of counting isochronous vibrations, and displayed considerable ability in calculations. When strong enough, he took pleasure in sounding the bells at school and church; and in his attention to town and church clocks, observed that the beats were 20 to 23 per minute, but more particularly 20, counting from the moment of departure to that of return. After this he endeavoured to force his attention to the preservation, as long as possible, of an *internal movement*, similar as to the extent of time and number of vibrations. "At first," he says, "by adding 20 vibrations to other 20, or minute to minute, he could easily arrive at the conclusion of an hour, and mark all the subdivisions which he wished, and that without confusion; but the thoughts and corporeal occupations suffered by this attention. By degrees I was able to count whilst thinking and acting; but I could not proceed far, because my mind, making a certain effort for a length of time, though but slightly sensible to myself, became fatigued, and dropped the chain of calculation. Nevertheless, in 1789, I succeeded in acquiring the invariable possession of this faculty, which has never since left or deceived me."

He was then 22 years of age, and occupied at a school; but, in consequence of some singular habits, as that of sounding bells, and of some mystical notions he had acquired, and also certain disputes about the correction of the village clocks, he was dismissed, and went to his mill, where, continuing to sound his bells and make his clocks strike, he was nick-named the Mummy of the Mill.

Being on board the steam-boat on the lake of Geneva (July 14, 1823,) he soon attracted attention by his remarks, that so many minutes and seconds had passed since they had left Geneva, or passed other places; and, after a while, he engaged to indicate to the crowd about him the passing of a quarter of an hour, or as many minutes and seconds as any one chose, and that during a conversation the most diversified with those standing by; and farther, to indicate by the voice the moment when the hand passed over the quarter minutes, or half minutes, or any other subdivision previously stipulated, during the whole course of the experiment. This he did without mistake, nowithstanding the exertions of those about him to distract his attention, and clapped his hands at the conclusion of the time fixed.

M. Chavannes then reverts to his own observations. The man said, "I have acquired by imitation, labour, and patience, an internal movement, which neither thoughts, nor labour, nor any thing, can stop; it is similar to that of a pendulum, which, at each motion of going and returning, gives me the space of three seconds, so that twenty of them make a minute, and these I add to others continually." The calculations by which he obtained subdivisions of the second were not clearly understood by M. Chavannes, but the man offered freely to give proof of his powers. On trying him for a number of minutes, he shook his head at the time appointed altered his voice at the quarter, half and three-quarter minutes, and arrived accurately at the end of the period named. He seemed to assist himself in a slight degree by an application of mnemonics, and sometimes, in idea, applied religious names to his minutes up to the fifth, when he recommenced; this he carried through the hour, and then commenced again. On being told that the country people said he made use of his pulse as an indicator, he laughed at the notion, and said it was far too irregular for any such purpose.

He admitted that his internal movement was not so sure and constant during the night; "nevertheless, it is easy to comprehend," he said, "that, when I have not been too much fatigued in the evening, and my sleep is soft, if, after having awakened me without haste, you ask me what the

hour is, I shall reflect a second or two, and my answer will not be ten minutes in error. The approach of day renews the movement if it has been stopped, or rectifies it, if it has been deranged. for the rest of the day" When asked how he could renew the movement when it had ceased, or was very indistinct, he said, "Sir, I am only a poor man; it is not a gift of Heaven; I obtained this faculty as the result of labours and calculations too long to be described; the experiment has been made at night many times, and I will make it for you when you please." M. Chavannes had not, however, the opportunity of making this experiment, but he felt quite convinced of the man's powers He states that the man is deaf, and cannot hear, at present, the sound of his clock or watch; and farther, that neither of these vibrate twenty times in a minute, which is always the number indicated by the motions of Chevalley when he wishes to illustrate his internal movement; and he is convinced, according to what he has seen, that *this man possesses a kind of internal movement, which indicates minutes and seconds with the utmost exactness.*

RAILWAYS.

(*Continued from our last.*)

It will be convenient, before we proceed farther, to give a short summary of the propositions already laid down respecting the motion of bodies on Railways, viz.—

1. The resistance to the motion of the body, arising from friction, is the same at all velocities; that is, the resistance is equal in equal times, whatever be the space passed over. This is the primary law established by the experiments of Vince and Coulomb.

2. It follows from this law, that a body impelled along a railway by any constant power, exceeding what is sufficient to overcome the resistance of friction (which is an uniform quantity,) will have its motion continually accelerated in the ratio of the squares of the times. A body, for instance, so impelled, which travels one foot or one yard in the first second, will travel three feet or yards in the next second, five feet or yards in the third, seven in the fourth, and so on. Its motion. if not strictly conformable to this principle, will at least approximate to it.

3. It follows also from the same law, that if the power expended in overcoming the inertia of the moving body in the earlier part of the journey, is saved by an impulse given at the moment of starting, the body will proceed exactly as it would have done, had it arrived at the same degree of velocity by its own accelerating power—that is, it will not only maintain the high velocity thus communicated, but increase it. In other words, the same constant power which would maintain a velocity of two miles, would equally maintain a velocity of 20 miles an hour. It is to be remembered that we take no account here of the resistance of the air.

We are afraid that some practical men will be disposed to treat these propositions as matter of idle and fruitless speculation. We confess this does not at all abate our confidence in their truth. We know that no useful improvement has ever been introduced without a hard struggle with their ignorance and prejudices, which create a species of moral resistance more intractable than the *vis inertiæ* of matter to the mechanician.

The most sanguine speculation, in our opinion, is often less offensive and less wrong-headed than your thorough-paced practical man, who is generally an incorrigible dogmatic as to the nostrums, right or wrong, which his own narrow experience has taught him,and stubbornly incredulous as to every thing beyond them. We believe, however, it will not be difficult to reconcile the principle we have been laying down with the results of every day's experience, as some may suppose.

We see nothing, it may be said, of the constant acceleration alluded to in the motion of a wagon on a level railway or common road (to the latter of which the laws of friction are applicable as well as the former.) But this is easily explained. The friction is a constant, and the horse's traction,

a variable quality. Suppose that a force of 90 pounds would exactly balance the friction, and that the horse begins to draw with a power of 100 pounds, proceeding at two miles an hour, the accelerating force is then 10 pounds; the horse, if he does not spare himself, will quicken his pace, perhaps, till he is travelling at the rate of three miles an hour. But though he exerts the same muscular energy now, he pulls only with a force of 81 pounds, while his friction requires 90. He will, therefore, gradually reduce his pace again to three miles an hour, at which rate, with the same expenditure of strength, he pulls with a force exactly equal to the friction; that is, 90 pounds.

The horse may either adjust the effort to the resistance in this way, or he may save his strength by walking slow, and pulling with a smaller force.

Every body knows that the rate of stage-coach travelling in this country has increased within the last twenty five years, and this too before the roads were M'Adamized, and with much less injury to the horses than was anticipated. Supposing that a coach-horse could run 14 miles, unloaded, with the same muscular exertion which carries forward the stage-coach at eight or nine miles, then Professor Leslie's formula becomes 3-4 $(14-v)^2$. Each horse would, of course, draw with a force of 48 pounds at six miles, and of 27 pounds at eight miles an hour. But if the friction increased in the ratio of the velocity, the load upon each horse would increase from 48 to 60 pounds, when the speed increased from six to eight miles an hour; and as the horse, exerting the same strength would only pull with a force of 27 pounds, he would thus have more than double work to do, which is plainly impossible. But admit that the friction is equal in equal times, then, since the time is diminished one fourth by increasing the speed from six to eight miles an hour, the horses have actually one fourth less to do; the load upon each is reduced from 48 pounds to 36. The fact, we believe, will be found strictly consistent with this hypothesis, and decidedly at variance with the other.

However strange then it may souud to common observers, it is practically true, that a smaller absolute amount of force will drag a coach over the same space in three hours than in four, and in one hour than in two.

Common roads, however, vary so much in the nature of their surface and their inclination, that the results they afford cannot easily be subjected to the calculations of the mathematician. With railways the case is otherwise; and we shall now show how the effects of a certain force of traction upon a horizontal road of this description is to be computed.—As the friction of a given body is a fixed and constant quantity, the power employed in impelling the machine may conveniently be divided into two portions; one to balance the retarding effect of the friction, the other to urge it forward, which, of course, constitutes the accelrating force. Let us then suppose that a foroe of traction equal to 200 pounds is applied on a railway to a wagon or a machine weighing with its load 30,000 pounds. Of this force let us suppose 100 lbs. to balance the friction; of course the remaining 100 pounds is applied to the acceleration of the machine.

Now, the accelerating force of 100 pounds is equal to the 300th part of the body to be moved. The machine will, therefore, advance through a 300th part of 16 feet in the first second; through three times this fractional space in the next second; five times the same space in the third second, &c. By pursuing this calculation, we find that the machine will travel 8 1-4 miles in 15 minutes, 33 miles in half an hour, and 130 in an hour. Such would be the result in space absolutely void, but a degree of speed approaching to this is rendered utterly impossible by the resistance of the atmosphere, which retards the motion from its commencement, and ultimately renders it uniform, however great may be the moving power employed.

It is to be observed, that with an accelerating force of double the one

assumed, (or 200 pounds,) the space gone over in the same time would be double; with a treble force (300 lbs.) it would be treble, and so on.

We shall now estimate the retarding effect produced by the resistance of the air. During high winds this resistance is so considerable, that means should be taken to lessen its amount: first, by making the vehicle long and narrow, rather than broad and short; and, secondly, by giving the front a round or hemispherical form. Let us suppose, then, that there are two steam vehicles, each weighing, with its engine, fuel, and load, fifteen tons. The one, a steam wagon, for conveying goods, is six feet high and five feet wide, and has, of course, a front of 30 square feet, which, in reference to the pressure of the air, is reduced to fifteen, by giving it a rounded form; the other, a steam coach, for carrying passengers, is eight feet high, and eight wide, or seven high and nine wide, presenting a front of sixty square feet, but reduced to thirty by its rounded form. Now still air is found by experiment to press with a force of sixteen grains upon a body presenting a front of one foot square, and moving at the rate of one foot in a second, and the pressure increases as the square of the velocity.

Hence, our steam coach, when moving at four miles an hour, in a still atmosphere, would encounter a resistance from the pressure of the air of 2 1-4 pounds; at eight miles an hour the resistance would be nine pounds; at twelve miles, twenty lbs.; at sixteen miles, thirty six pounds; at twenty miles, fifty-seven pounds. The steam wagon, presenting only half the surface in front, would experience only half the resistance.—

Let us assume, according to what we have already stated, that a power of 100 pounds would just put the steam coach in motion; then, if we allow an additional power of 33 lbs. for acceleration, making 133 pounds altogether, we find, that if the air did not oppose its progress, it would move over forty-three miles in one hour. But since it is propelled only by a force of thirty-three pounds, as soon as the resistance of the air pressed it back with a force of 33 pounds, the acceleration would cease, and the motion become uniform. Now, this would take place within 15 or 20 minutes, and when the velocity had risen to fourteen or fifteen miles an hour. With the steam wagon, presenting only half the front, the velocity would become uniform, at twenty-two miles an hour.

Hence we see that if we had always a perfect calm in the atmosphere, we could impel 15 tons along a railway with a velocity of 15 or 22 miles an hour (according to the extent of the surface the vehicle presented,) by a force of 133 pounds.—We may now compare the resistance of a railway with that of a canal or arm of the sea in a calm atmosphere.

According to the table formerly given, the force required to propel a vessel weighing with her load, fifteen tons through water at different velocities, would be as follows:

At 4 miles per hour - -	133 lbs.
6 - - - - - - - - -	300
8 - - - - - - - - -	533
12 - - - - - - - -	1200
16 - - - - - - - -	2133
20 - - - - - - - -	3325

On a railway, we have merely to add the power required to overcome the friction (100 pounds) a few lbs. more to balance the resistance of the atmosphere at the velocity proposed. For the steam coach, with thirty feet of front, it would be as follows:

At 4 miles per hour - - -	102 lbs.
6 - - - - - - - - -	105
8 - - - - - - - - -	109
12 - - - - - - - - -	120
16 - - - - - - - - -	137
20 - - - - - - - - -	158

We see, from this table, the astonishing superiority of the railway over the canal, for all velocities above four miles an hour. Nearly three times as much power would be required to move an equal mass at six miles an hour on a canal as on a railway; five times as much power would be required at eight miles an hour, ten times as much at 12 miles.

15 times as much at 16 miles, and 21 times as much at 20 miles an hour.

It is evident, also, that an addition of power too trifling to add any thing material to the weight of the vehicle, would raise the terminal or uniform velocity from four miles an hour to twenty; and that, speaking practically, it would cost no more to command a velocity of twenty miles an hour on a railway than a velocity of one. Except for the chances of injury to the railway or the vehicle, there would not be the smallest reason for conveying goods, even of the coarsest kinds, at four miles, rather than at 20 miles an hour.

But a perfect calm in the atmosphere is very rare, and vehicles intended for daily and constant use, must be prepared to contend with the strongest winds. The power must, therefore, be increased to such an extent as to enable the vehicle to travel at its wonted pace in all weathers.—Now, according to Mr. Smeaton, "a hard gale" is found to sweep along the surface of the earth at the rate of from 40 to 50 miles an hour. This velocity, which would be increased to 60 or 70 by that of the steam coach when travelling at twenty miles an hour, would produce a resistance of 600 pounds upon the the thirty feet of front of the steam coach, or 300 pounds upon the front of the steam wagon. With a speed of eight miles an hour, the coach and wagon would encounter a resistance about one half less. The vehicles, however, should not be constructed entirely with a view to extreme cases; and, except for the conveyance of mails, and some similar purposes, an average velocity of twenty miles an hour, for vehicles of the weight and description mentioned, would be secured by a power varying from 200 to 500 pounds; that is, from one fifth to one tenth of the power required to produce the same effect on water.

We see, however, that the resistance of the air, which, in vulgar apprehension, passes for nothing, comes to be the greatest impediment to the motion of the vehicles, and may in some cases absorb five parts in six of the whole power. Let it be remembered, at the same time, that this aerial resistance rises into consequence solely because the high perfection of the machinery, the vehicle, and the road, almost annihilates every other. The atmosphere equally opposes the progress of the stage coach, the track boat, and the steam boat; but the motion of these vehicles is comparatively so slow, and the power of impulsion required to overcome the other impediments is so great, that the resistance of the air is disregarded.

In discussing this subject so much in detail, we have, perhaps, exceeded what is suitable to our limits; but it is singular, that, so far as we know, the application of the laws of friction to the motion of carriages on railways has scarcely ever been investigated. Among all the new projects and inventions with which this age teems, there certainly is not one which opens up such a boundless prospect of improvement, as the general introduction of railways for the purpose of commercial communication.

We have spoken of vehicles travelling at 20 miles an hour; but we see no reason for thinking that, in the progress of improvement, a much higher velocity may be found practicable. Tiberius travelled 200 miles in two days, and this was reckoned an extraordinary effort; but in our times, a shopkeeper or mechanic, on the most ordinary occasion, travels twice as fast as the Roman emperor; and twenty years hence, he may probably travel with a speed that would leave the fleetest courser behind.

Such a new power of locomotion cannot be introduced without effecting a vast change in the state of society. With so great a facility and celerity of communication, the provincial towns of an extensive empire would become so many suburbs of the metropolis; or rather the effect would be similar to that of collecting the whole inhabitants of a country into one city. Commodities, inventions, discoveries opinions, feelings, would circulate with a rapidity hitherto unknown; and, above all, the personal intercourse of man would be prodigiously increased. Were the ugly despotisms that retarded civilization on

the Continent annihilated, Europe might be made, as it were, one family, by such a system of internal communication.

(*To be continued.*)

ON DEAD LIME.

It has long been observed by lime burners, that if lime is imperfectly burnt in the first instance, no farther exposureof it to fire will produce quick lime;* but the philosophical chemists have doubted the truth of this observation.

Mr. Vicat, however, in a work he has lately published upon mortar and stucco, has confirmed the observations of the lime burners.

He found, that in making quick lime in a small furnace, if the small pieces of lime stone, which fell through the grate into the ash-pit before they were thoroughly burnt, were collected and put again into the fire, even for several successive times, quick lime was not obtained; but a kind of lime, technically called dead lime, which will not slake with water, but which, on being ground and made into paste with water, differs from common mortar by setting under water.

When chalk (*limestone or marble*) is burnt, and the lime left to fall into powder by long exposoure to the air, and then made into a stiff paste with water, it sets very sensibly under water, so that the action of the air seems to produce a dead lime similar to that produced by the incomplete burning of limestone; being neither pure quick lime, nor a complete carbonate of lime, but a kind of sub carbonate, which possesses "the new and useful property of setting under water."

Mr. Raucourt de Charleville observed the same effects to be produced as were observed by Mr. Vicat. He also made another observation, respecting the production of a cement which sets under water.

He had prepared a mixture of quick lime and clay, and left it to dry; some of this was then broken into small pieces, and burnt on a heated cast iron plate, and another parcel in a small furnace, mixed with the charcoal used as a fuel. In these experiments, it was observed, that the pieces of this mixture of quick lime and clay, which were burnt on the heated plate, produced mortar that set under water;† but those burnt with charcoal. produced mortar which did not set under water.

Mr. Clement, when he gave an account of a mineral found by Mr. Minard, in France, and which was fit for the making of hydraulic mortar or Roman cement, stated it to be Mr. Minard's opinion, that the cause of the Roman cement setting under water, was owing to a sub-carbonate of lime, produced by the action of fire on the natural carbonate, as the chemists epeak; or, in other words, to imperfect lime.

London Journal.

MATHEMATICAL HABITS.

Joseph Suaveur, the eminent French mathematician, was twice married; the first time he took a very singular precaution; he would not meet the lady till he had been with a notary to have the conditions, which he intended to insist on, reduced into writing, for fear the sight of her should not leave him sufficiently master of himself. This says, Dr. Hutton, was acting very wisely, and like a true mathematician, who always proceeds by rule and line, and makes his calculations when his head is cool.

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* Quick lime, a term used to distinguish burned or caustic lime, from that which is unburned.

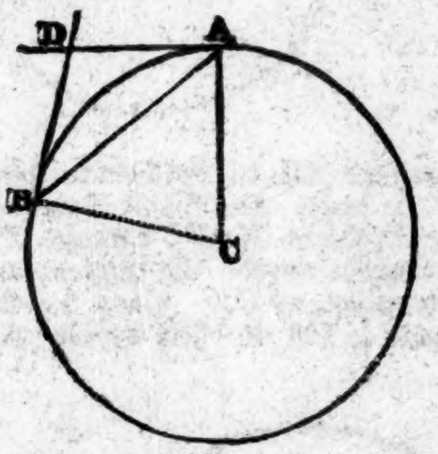
† In Philadelphia it is the practice amongst some of the plaisterers, to add a small portion of clay (about 1-10) to the lime intended for washing walls. Blueing is also added, so as to give, when first laid on, quite a perceptible shade. As it dries, the colour diminishes, and the clay combining with the lime, forms a hard surface, which does not rub off as lime does when used by itself.—Ed.

MECHANICAL GEOMETRY.

(Continued from our last Number.)

THEOREM VII.

If from the two extremities of any chord tangents be drawn to the point where they meet the circle, they will intersect each other at equal distances from the extremity of the chord.



Let AD and BD be two tangents to the points A and B, drawn from the extremity of the chord AB, the point where they intersect at D will make AD equal BD.

From A and B draw AC and BC to the centre of the circle, then we have shown (Theorem v. Part II.) that the angles DAC and DBC are both right angles. Now, as AC equals BC, the angles ABC and BAC (by Theorem iv. Part I.) are equal; now if we take these equal angles from the angles DAC and DBC, the remainders of those angles, viz DAB and DBA will also be equal to each other; hence, in the triangle DAB, the angles at A and B being equal, the sides AD and BD must also be equal (by Theorem iv Part I.) Hence, the tangent AD and BD are shown to be equal, as was required.

COROLLARY I.—Hence, if from the extremities of any chord two tangents are drawn, they will form an isosceles triangle, whose equal angles (at the base) are measured by half the angle the chord subtends, and the angle at the vertex is measured by the supplement of the arc to which the chord corresponds: that is, supposing the chord to include 60 degrees of the whole circumference, the angles the tangents make with the chord will be each 30 degrees, and the angle the two tangents make with each other will be 120 degrees, or a semicircle (180 degrees) wanting 60 degrees.

COROLLARY II.—Hence, if the tangents are perpendicular to each other, the chord from which they are drawn is a chord of 90 degrees, and the two tangents with the two radii drawn from their extremities to the centre of the circle form a square.

NOTE.—We will now deduce some practical Problems from the foregoing Theorem.

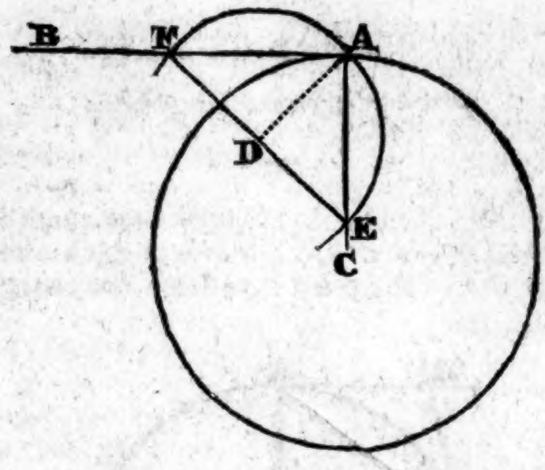
PROBLEM VIII.

To draw a *tangent* to a circle from any given point.

This Problem admits of two cases.

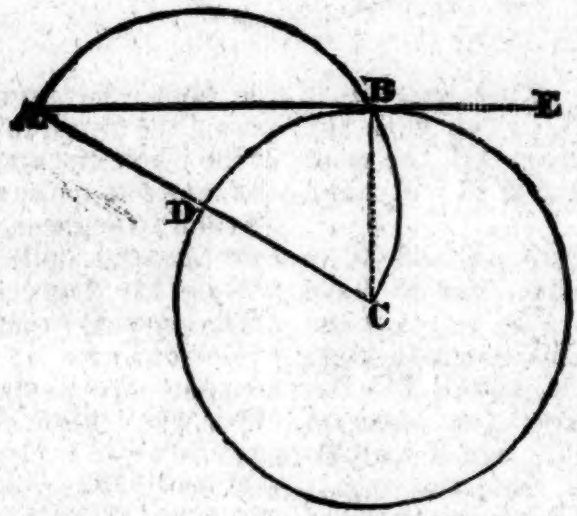
CASE 1.—When the point is in the circumference of the circle.

Let A be the given point from which it is required to draw a tangent.



From A draw the radius AC to the centre; then from A erect the perpendicular AB (by Problem II. Part II.) and it is the tangent required. Thus assume any point, as D, and with a radius equal to DA describe the circle FAE, and through E and D draw EDF cutting EAF in F; through F draw AFB, and it is the tangent required.

CASE 2.—When the point is situated without the circle.



Let A be the given point situated without the circle; BD, to which we are required to draw a tangent.

From A draw the line ADC to the centre of the circle; then bisect the line AC (or divide it into two parts) in D (by Problem VII. Part II.;) then, with DA or DC as radius, describe the semicircle ABC, and where this cuts the circle BD in B, draw the line BA; then is BA a tangent to the circle BD, and drawn from the point A, as required.

NOTE.—We may here observe, that the truth of this Problem is manifest, for the angle BAC in the first case, and ABC in the second, is the angle in a semicircle, and, consequently, (by Theorem III. Part II.) it is a right angle, or the lines are square to one another; and (by Theorem V. Part II,) when that is the case, the line AB is a tangent to the circle.

I shall here also take occasion to remark, that though AB is, *strictly speaking* a tangent to the point B, (see last fig.,) yet, if AB is produced to E, the whole line is mechanically understood to be the tangent line to the point B of the circle; but when the tangent is used as a line for the purpose of comparing the relative value of the sides of triangles, for the purposes of mensuration, &c. the line AB is always understood to terminate at the circumference in the point B, and is said to be a tan-

gent of so many degrees, according to the length of it when compared with the radius of the circle; thus, in the figure above, if the angle BCA is an angle of 60 degrees, for instance, the tangent BA is said to be a tangent of 60 degrees, and the line AC is called a *secant* of 60 degrees

G. A. S.

[*To be continued.*]

SIR,—In this age of inventions when so many *new* things are presented for public consideration, permit me to offer an *old* one in a new dress, which I think may be used to great advantage.

There is nothing new in the ideas I have to suggest, so far as they relate to principles of science, and yet there may be in the application.—Twenty-four years since, when I first conceived the theory of this thing, I had in contemplation a trip across the Atlantic, at some distant day, and a series of experiments and demonstrations. But, circumstances admonish me that this hope should no longer be indulged. I have partially tested the plan, and if others can make it useful, and be the means of doing good, let them make the most of it.

A small apparatus, at a trifling expense, may be so constructed as to produce a very bright light, which may be thrown upon the clouds in any direction, and made visible for many miles, in all directions.

Line a semisphere with metallic or other reflectors, so as to receive the light from a number of lamps. and reflect it in any direction, the lights and reflectors turning on a common pivot. In a night of common darkness, a dozen good lamps will enable the operator to exhibit his light in the clouds, perfectly visible, at distances of from ten to twelve miles. I have done this in a machine that cost less than fifty dollars, so that the light has been seen near a hundred miles distant from the operator.

Ships at sea, in distress, could throw signals, in this way, to such distances as almost always to reach the eye of somebody, and gain relief. In very dark nights the effect is astonishing. Telegraphic signals may be so arranged, that ships crossing the Atlantic may speak others at immense distances, and report them on their arrival, always a *day's sail in advance*. The water may be examined, all around a vessel, with such an apparatus, at any hour of night, almost as minutely as by daylight. Letters of the alphabet, various figures of animals, &c. may be exhibited in the clouds, many miles distant, and changed in an instant, as well the figure as the position, over a space equal to the whole extent of the power of the light.

Suppose a Liverpool packet, sailing from New-York, goes fitted out with an apparatus of this kind, calculated for a focal distance of one to two or three miles Let her exhibit her light every night, going and returning, in the clouds and the air over her course. The great number of vessels near her track that would report the strange lights they had seen, in all the ports where they arrive, would demonstrate the use that might be made of this contrivance, and that the theory is no ingenious fallacy.

The power of the light may be made to extend sixty miles, or more; but the shorter its range, in the first experiment, the less will be the expense. Suppose she is approaching some coast, in distress; the signal being known, she gives her call for help, and her own exact position, in so wide a range, that relief may come in season. This is my object, and God grant that relief may come.—I believe it may be the means of saving many lives.

It may not be amiss to add, that, during the late war, when the inhabitants of a certain maritime district were greatly annoyed by apprehensions of nocturnal visits from the enemy's shipping, I gave a model of this plan to a friend, but I believe it was never called into use, the war having ended about that time. S.

New-York, March 23, 1825.

PROJECTED JUNCTION OF THE PACIFIC AND ATLANTIC OCEANS.

A project for opening a water communication between the Atlantic and Pacific oceans, through the provinces of Darien, Biriquete, and Zitara, is seriously agitated; and from the splendour and importance of the object, the enterprise and ability of the undertakers, and the liberal and enlightened policy pursued by the government of Colombia, we doubt not it will be very speedily accomplished.

The route is one of those named as exceedingly practicable by the Baron Humboldt, and as having been navigated more than fifty years since, with petiaugers, loaded with the produce of the Pacific shores, during the wet seasons of the year.

It is through the Rio (river) Atrato and Rio San Juan; the former of which debouches into the bay of Candelaria, in the gulf of Darien and is navigable for vessels drawing seven feet water about four hundred miles, to the city of Zitara, and from thence through the Rio Quito to the Tombo S. Pablo. Though this navigation is interrupted by some falls or rapids, it is capable of being improved, for four feet draught of water, at no very great expense.

The San Juan is also navigable for boats drawing five or six feet water as far up as the river Tamana or to within eighteen or twenty miles of the Tombo S. Pablo. The mouth of this river does not, however, afford a good harbour, though there is a road stead with very excellent anchorage. Proceeding southwardly, however, we soon come to the bay of Buenaventura, which is one of the best *harbours in the Pacific ocean*, and which may be connected, through very favourable ground, by a cut of twelve miles in length, to the Rio Calima, which flows in almost a direct course, into the Rio San Juan.

The summit level between the last named river and the Atrato does not exceed twenty-four feet, being alluvial and free from rocks, and the site is truly favourable for a canal. The lofty ranges of the neighbouring mountains, which, in this place, seem to have been intercepted for the convenience of man, afford an abundant supply of water, and the course of the upper part of the river San Juan is capable of being diverted so as to constitute a never-failing feeder.

These rivers, particularly the Atrato, are rapid, the current flowing in many places at the rate of three or four miles per hour; but the navigation, unlike that of the Mississippi, is not rendered dangerous by drift wood, *planters and sawyers*. The distance from ocean to ocean in the direction of the rivers, and the proposed canal is computed at about seven hundred and fifty miles, and it is expected that steam boats, constructed in nearly the form of our canal boats, and drawing from three to four feet water, will run it on an average in seven or eight days, and there is no scarcity of fuel. Such is the information we have collected on this highly interesting subject; and, from the respectability of the sources from which it has been received, we feel satisfied of its correctness.

The execution of this measure will unquestionably produce a revolution in a portion of the commerce of the world; the western shores of our continent will be virtually approximated to the eastern, and even to Europe; new marts of commerce will spring into being; steam boats will disturb and ruffle the surface of the Pacific ocean; and the tea, spices, silks, &c. of the Indies, the oil, fish, and furs of the North-west coast, and the precious metals of Peru, will, instead of following the circuitous and dangerous routes now traversed, find their way almost directly to our markets.

A new era will commence, and the citizens of nations now too often armed in hostile array against each other, will from frequent intercourse, become acquainted with the peculiarities of each other, and associate like brothers of the same community. Such at least is the prospective of this magnificent work, and such we trust in Heaven will be the reality.

FULTON.

New-York, April, 1825.

**A transcript of the contemplated route may be seen at J. V. Seaman's, Bookseller, Broadway.

BREWSTER'S WOOL SPINNING MACHINE

Extract from a memorial presented to the Legislature of the State of New-York, in March last.

Gilbert Brewster, Esq, of the State of Connecticut, has invented a machine for spinning wool, which he has exhibited in this city, and is now to be seen in operation in the senate lobby, which as a labour saving machine far surpasses any thing of the kind I have ever seen in this or any other country.

I have seen it in operation, and have carefully and minutely calculated the difference of expense in spinning between this machine and the hand jennies now in use in our factories and from a practical knowledge of the business, I have no hesitation in saying that there is a saving of labour, equal at least to 60 per cent. This machine can be propelled by water, steam, or hand power; it spins from the rools, consequently supersedes the necessity of roping; inexperienced boys or girls can attend it as well as the most experienced spinner, and I am fully convinced that the use of these machines in our woollen factories will afford a protection equal to an additional duty of 15 per cent. on foreign cloths

The object of your memorialist is to submit to the consideration of your honourable body the policy and propriety of adopting the use of those machines in your state prisons and county poor houses, whereby indigent women and children, and such of your convicts as are not sentenced to solitary confinement, can be profitably employed; and I have no doubt that instead of your state prisons being a constant and heavy drain upon your treasury, they would become a very considerable source of revenue. With a view then to effect this desirable object, it would be indispensably necessary, in order to reap the extent of the benefits to be derived from this plan, to locate the new state prison which is contemplated to be built, as well as your county poor houses, in such place and places where sufficient water power can be applied to propel the machinery.

In adopting this plan, your honourable body will readily perceive, that you not only establish two great state woollen factories, but also one in each county within the state, where poor houses are required to be built, and thereby give profitable employment to your paupers and convicts This subject is also in a national point of view, one of great importance, as our national government is becoming sensible that the true policy of all wise governments is to promote and encourage the arts and sciences, as well as every species of home industry, as objects of primary importance, in all free and well regulated governments: for it must be admitted, that the wealth of a country depends altogether on the industry and enterprise of its citizens, and the acts of the government will never fail to secure the affections of the people.

New York has immortalized herself by her great canals, which have given facility to her intercourse, and activity to her commerce. She has taken the lead in the great field of internal improvements; let her preserve her proud pre-eminence among her sister states She has put her hand to the plough, let her not look back; she has done much, and much yet remains to be done. Every step advanced accelerates the force, and multiplies the means, for human ingenuity has no assignable limits.— The ocean of moral resources has never been fathomed, and is perhaps without shore or soundings. Our citizens are intelligent, inventive and enterprising, and there is none, perhaps, more so than Mr. Brewster; who. by his ingenuity and skill has contributed very materially to advance the useful arts, by which, society has been enabled to substitute for natural labour, the employment of that, which, being furnished by artificial contrivance, is less expensive

The attention of the American people is anxiously directed to the policy of encouraging manufactures from domestic materials, as the most practicable mode of speedily advancing the substantial and permanent good of all classes, as all governments

which have adopted the policy of building up and supporting manufacturing interests by legislative provisions and patronage, have in the end proved their wisdom, by the diffusion of science, ease and affluence.

Your memorialist would beg leave farther to observe, that 5,000 dollars will be sufficient for the purchase of all the necessary machinery, in order to establish a woollen factory in either of your state prisons, (exclusive of buildings) and for county poor houses, from 1000 to 2000 dollars.—The state to order by law an appropriation for the former, and the counties respectively for the latter, all which is most respectively submitted for the consideration of the legislature.

GEO. M'CLURE.

Albany, 18th March, 1825.

Mr. Brewster's wool spinning machines, in one form or other, have long been in use in our country, and the experience of our woollen manufacturers has proved their great impotance and utility.

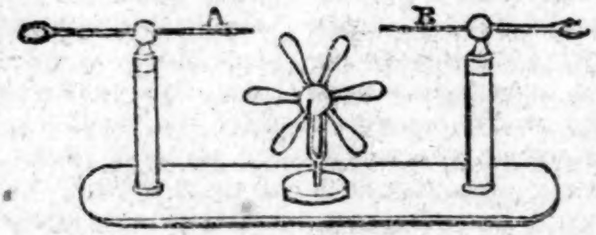
The one above alluded to, is an improvement on those inoperation on the Brandywine, in the state of Delaware, inasmuch as it spins the wool from the rool, while the latter spin from the rope, and consequently with less uniformity in the evenness of the thread: besides, it is not so simple in its structure, and requires more care and attention. The public are indebted to Mr. Brewster for them both; and we sincerely hope it will not withhold the reward due his ingenuity, imdustry and perseverance.

A specimen of cloth manufactured from the rool spinning machine, may be seen at the publisher's.—Ed.

MECHANICAL EFFECT OF ELECTRICITY.

The Mechanical Effects of Electricity are exhibited in its power of impelling and dispersing light bodies; of perforating, expanding, compressing, tearing, and breaking to pieces, all conducting substances through which it is sufficiently powerful to force its passage.

If a light wheel, having its vanes made of card paper, be made to turn freely upon a centre, it will be put in motion when it is presented to an electrified point. The wheel will always move from the electrified point, whether its electricity is positive or negative. In this experiment the current seems to be produced by the recession of the similarly electrified air in contact with the point, and therefore the circumstance of the wheel turning in the same direction when the electricity is negative, cannot, as Mr Singer has remarked, be considered as any proof of the existence of a double current of the electric fluid. As an illustration take the following experiment:—



Place upon an insulating stem a light wheel of card paper, properly suspended upon pivots, as represented in our Plate, and introduce it between the pointed wires (AB) of the universal discharger, placed exactly opposite to each other, and at the distance of little more than an inch from the upper vanes. Then having connected the wire A with the positive conductor, and the wire B with the negative conductor, of an electrical machine, the little wheel will revolve in the direction AB; and if the wire B is connected with the positive end, and A with the negative end, the motion of the wheel will be from B to A. The transmis-

sion of a small charge through the wires, by an insulated jar, will produce the same effect.

The preceding experiment, imagined by Mr. Singer, is considered by him as a proof that there is only one electric fluid, and that it passes from the positive to the negative wire; for, if there were two electric fluids he concludes "that the wheel being equally acted upon by each, will obey neither, and remain stationary."—*Chemist*

SIR,—Although I have taken in your publication from its commencement, I should not have trespassed on your time had I not seen in last week's Magazine, some observations by your correspondents T. H. B. and T. M. B. relative to the enormity of disturbing the dead in their last resting-places. Perhaps these Gentlemen are not aware, that it is impossible for any man to exercise the profession of medicine without an intimate knowledge of the parts of the human frame, and the functions of all the vital organs, which cannot be acquired in any other way than by actual dissection; the toil of which, combined with the noisome stench attending it, ought, I think, to shield us from the scoffings of those persons who do not know how absolutely necessary a perfect acquaintance with anatomy is to the medical student. That great luminary of our profession, the late John Hunter, used to observe, that for a man to practise surgery without knowing anatomy, was like a child in a powder magazine with a lighted match in its hand. Your correspondent very *facetiously* says, "Why do not the surgeons bequeath their own bodies for dissection?" to which I beg leave to answer, that if every medical man in the United Kingdoms was to surrender up his carcase after death, still would there be not one fortieth part enough to satisfy the remainder of the living fraternity. On an average, there is in London at this time eight or nine hundred medical students, every one of which number ought carefully to disect two or three bodies before entering upon his duty as a surgeon. As the ignorance of this part of our science is often fatal to the patient, so the thorough knowledge of it is certainly to be considered a point of no small importance.

I augur, from your well-known impartiality, that you will insert this answer to T. M. B., and by so doing you will oblige,

MEDICUS.

London, Janurary 1825.

SUPERIOR PROCESS OF WASHING OVER EMERY.

The genuine Emery-stone is brought to us from Naxos, one of the islands in the Greek Archipelago. It is found in hard, compact, stony masses, of a bluish purple colour, interspersed with pyrites. These lumps of emery are used in their native state, in Sweden, to shape porphyry into slabs, mortars, &c. being held firmly against the masses of porphyry, whilst the latter are turned in large lathes moved by the power of water. They are also used in this country by the glass-cutters to turn their cast-iron laps into shape; and the emery made from them is greatly preferable to any other in its effects upon the articles to be cut or abraded by it, owing to its great hardness. This valuable property of hardness, however, has increased the difficulty of manufacturing emery from it; and, accordingly, substitutes have been found for it, which fall vastly short, indeed, in this very desirable quality.

Mr John Isaac Hawkins has lately introduced a mode of preparing emery for nice purposes, which appears to be of a very superior description. He was led to it by finding that the emery commonly sold was totally inefficient for the purpose he had in view, namely, grinding two flat surfaces of hard cast-steel accurately; as the workman found that only a few of the coarser parts of the emery scratched the surfaces of the steel plates, and kept the remainder of it from acting at all; and, in fact, that his labour was in vain. On this Mr. Hawkins thought of applying a process which he had seen used in Liverpool for washing-over *diamond dust*, to be used in watch-jewelling, to emery; and in order to be sure that his emery should be of a good quality, he took the precaution of purchasing, at an eminent emery maker's, a quantity of

those small lumps or grains of emery which had longest withstood the action of the cast-iron runners and bed, and thus ensured the *hardness* of the emery. These lumps he caused to be reduced to powder in a mortar of cast-iron, and then sifted the powder into different varieties, by passing it through a series of wire-seives ; the first seive having 20 squares in the inch, the next 30, and so on to 80 : and thus he obtained eight different degrees of emery.

He next treated the emery which had passed through the finest seive, by washing it over in the same manner as the diamond-dust was treated, namely, in *oil, which held it suspended for a much longer time than the water.* which is usually employed for this process: and in this way he obtained a series of emery which had floated one minute, five minutes, ten minutes, fifteen minutes, twenty minutes, forty minutes, and 80 minutes; amongst which he found every variety necessary for his purpose, and deposited them in separate boxes for use, numbered according to the minutes they had floated; and he could thus, at any subsequent period, be certain of producing other emeries of the very same description.

We need hardly add, that by using these latter emeries in succession, beginning with the coarsest, he not only very soon accomplished the object he had in view, but has also since employed them in grinding three flat circular plates of cast iron to perfectly plane surfaces, correcting, as usual, the tendency in either to become concave or convex, by means of the third plate.

EMERY HARD ENOUGH TO CUT RUBIES.

Mr. Hawkins, in pursuing the same practice of selecting those grains of emery which resisted longest the action of the pestle and mortar, eventually obtained some *so hard* as to be capable of *cutting a ruby*, when employed in a similar manner to *diamond dust* in watch jewelling. He has also found it desirable sometimes to separate his emery by washing it over in one, two, three, four, and five minutes, and so on, as before mentioned.

SAPPHIRES FOUND IN THE GREEK EMERY STONE.

The Editor of the *Technical Repository* states, that he has lately treated some portions of the Greek emery stone by grinding them to powder between two flat and hard steel surfaces and washing off the lighter parts in oil; he then placed a small portion of what had subsided, after floating only half a minute, upon a slip of glass, and examined it in the microscope, under a highly magnifying power, and found that many parts of it had entirely withstood the grinding action (except only their being separated from the mass,) and were, in fact, *perfectly crystallized sapphires!*

COTTON MANUFACTURE.

	lbs.
The quantity of cotton converted into yarn in Great Britain and Ireland in one year is about - - - -	160,000,000
The loss in spinning may be estimated at 11-2 oz. per lb. - - - -	15,000,000
Quantity of yarn produced - -	145,000,000
Amount, supposing 18d. to be the average price per lb. - - -	£10,875,000

According to Mr. Kennedy's calculation, that every person employed in spinning produces 900lbs per ann. the number of persons employed is . . . . : . 161,111

The number of spindles employed, supposing each to produce 15lbs. per ann. is 9,666,666

The capital invested in buildings and machinery, cannot be less than . . . . . 10,000,000l.

QUERE.

Is there any liquid or preparation known, with which a room, ornamented with size-colouring, may be washed, so as not to shine like varnish, and which will bear cleaning with water?

COMMUNICATION

S. on Canals is received, and will be noticed in our next.